

# The effects of household and workplace smoking restrictions on quitting behaviours

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## Abstract

**Objective**—To assess the association of household and workplace smoking restrictions with quit attempts, six month cessation, and light smoking.

**Design**—Logistic regressions identified the association of household and workplace smoking restrictions with attempts to quit, six month cessation, and light smoking.

**Setting**—Large population surveys, United States.

**Subjects**—Respondents (n = 48 584) smoked during the year before interview in 1992–1993, lived with at least one other person, and were either current daily smokers or were former smokers when interviewed.

**Main outcome measures**—The outcome measures were an attempt to quit during the last 12 months, cessation for at least six months among those who made an attempt to quit, and light smoking (< 15 cigarettes a day).

**Results**—Smokers who lived (odds ratio (OR) = 3.86; 95% confidence interval (CI) = 3.57 to 4.18) or worked (OR = 1.14; 95% CI = 1.05 to 1.24) under a total smoking ban were more likely to report a quit attempt in the previous year. Among those who made an attempt, those who lived (OR = 1.65, 95% CI = 1.43 to 1.91) or worked (OR = 1.21, 95% CI = 1.003 to 1.45) under a total smoking ban were more likely to be in cessation for at least six months. Current daily smokers who lived (OR = 2.73, 95% CI = 2.46 to 3.04) or worked (OR = 1.53, 95% CI = 1.38 to 1.70) under a total smoking ban were more likely to be light smokers.

**Conclusions**—Both workplace and household smoking restrictions were associated with higher rates of cessation attempts, lower rates of relapse in smokers who attempt to quit, and higher rates of light smoking among current daily smokers.

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Keywords: smoking cessation; smoking restrictions

Recent reviews have shown that environmental tobacco smoke (ETS) places non-smokers at risk of lung cancer, heart disease, and a range of respiratory illnesses.<sup>1–3</sup> Concerns about ETS have prompted governmental bodies from the local to the national level to adopt laws and regulations to protect non-smokers from ETS.<sup>4</sup> The primary method of protecting non-smokers in enclosed work and public areas has

been to restrict smoking. If compliance is high, workplace smoking restrictions, especially total bans, are an effective means of protecting non-smokers from ETS. In addition, workplace smoking restrictions have been shown to increase cessation<sup>5–9</sup> while decreasing consumption in continuing smokers.<sup>5–7,17</sup>

Home smoking restrictions, although less studied than workplace restrictions, may have effects similar to those observed for workplace restrictions. When compared to homes with no restrictions, total household bans on smoking were shown to reduce ETS exposure in adolescents who lived with a smoker by 92%, while partial household restrictions (for example, only smoking in certain rooms or at certain times) were shown to reduce ETS exposure by more than 60%.<sup>18</sup> Data from California suggest that household smoking restrictions may be even more effective in increasing cessation and reducing consumption than workplace restrictions.<sup>9,19</sup>

Research has shown that current smokers who reported a quit attempt of a week or longer in the last year are more likely to achieve cessation during the next 18 months than those who did not.<sup>20</sup> Light smokers, defined as those who consume less than 15 cigarettes a day, are about twice as likely to quit smoking in the next 18 months as those who smoke more heavily.<sup>20,21</sup> Thus any intervention that promotes reduced consumption or increased quit attempt duration is likely to increase the eventual chances of successful cessation. In this article, we compare the relative effectiveness of workplace and household smoking restrictions in promoting quit attempts and successful cessation, using a nationally representative sample of current and recent former smokers.

## Methods

### DATA SOURCE

Data are from three current population surveys (CPS) (September 1992, January 1993, and May 1993) that included a special supplement on tobacco use. The US Bureau of Census continuously conducts the CPS for labour force monitoring, covering the civilian, non-institutionalised population, aged 15 years and older.<sup>22</sup> The CPS are household surveys that select a stratified probability sample of clusters of households identified from the US Census and other sources.<sup>22</sup> The CPS design calls for surveying about 56 000 households each month by conducting interviews with a knowledgeable household member who responds for all eligible household members. Each household is part of a panel that is interviewed eight times over a 16 month period. All

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respondents to the tobacco use supplements that are reported here were interviewed only once in either September 1992, January 1993, or May 1993. About a quarter of the interviews were conducted in person (first or fifth time in a panel); the remainder were conducted by telephone (second/third/fourth or sixth/seventh/eighth time in a panel).<sup>23</sup> For the tobacco use supplement, the CPS attempted three contacts to maximise the proportion of self respondents who completed the supplement.<sup>23</sup> Response rates for the tobacco use supplement were 88.5%, 89.1%, and 86.1% for September, January, and May, respectively.

The households in the combined sample contained 434 161 individuals aged less than one year to 90 years. Of these, 118 201 were eliminated because of age (that is, < 18 years) and 42 665 were eliminated because they lived alone. This left an initial sample of 273 295 eligible adults, of whom 191 068 (69.9%) were self respondents, 48 616 (17.8%) were proxy respondents, and 33 611 (12.3%) were non-respondents.

#### MEASURES OF SMOKING, DEMOGRAPHIC VARIABLES, AND SMOKING RESTRICTIONS

Supplement respondents over the age of 17 years who lived with at least one other person ( $n = 191\,068$ ) were asked, "Have you smoked at least 100 cigarettes in your entire life?" Those who responded "no" were classified as never smokers ( $n = 98\,048$ ), and those who responded "yes" ( $n = 93\,020$ ) were asked, "Do you now smoke cigarettes every day, some days, or not at all?" Respondents who answered "not at all" were classified as former smokers ( $n = 46\,492$ ), those who answered "every day" were classified as current daily smokers ( $n = 38\,541$ ); those who answered "some days" were classified as occasional smokers ( $n = 7812$ ) and were not used in the analysis.

Only current daily smokers were asked, "During the past 12 months, have you stopped smoking for one day or longer because you were trying to quit smoking?" The cessation analyses were restricted to current daily smokers ( $n = 38\,541$ ) and former smokers ( $n = 10\,043$ ) who smoked during the previous 12 months. All former smokers and those current daily smokers who answered "yes" were credited with having made an attempt to quit in the previous year. To determine successful cessation, former smokers were asked, "About how long has it been since you completely stopped smoking cigarettes?" Successful cessation was defined as complete abstinence for at least six months. This is an accepted definition of successful cessation.<sup>24</sup> It should be noted, however, that many of the individuals who had currently quit for less than six months at the time of the survey, especially those who had quit for at least three months, will eventually remain abstinent for longer than six months. Thus the analysis of successful quitting is conservative.

To determine cigarette consumption, current daily smokers were asked, "On the average, how many cigarettes do you now smoke a day?" Current smokers who reported

smoking less than 15 cigarettes a day were classified as light smokers, while those who smoked 15 or more cigarettes a day were classified as moderate to heavy smokers.

Data from the standard labour force core questionnaire were used to create dummy variables for the following demographic variables: respondent's sex, age group (18–24, 25–34, 35–44, 45–54, and 55 or more years of age), ethnicity (non-Hispanic white, African American, Hispanic, and other), and level of education (no college *v* some college), occupation (managerial and professional; technical, sales and administrative support; service; precision production, craft and repair; operators, fabricators and labourers; farming, forestry and fishing; unemployed), family income (less than \$15 000, \$15 000–\$30 000, \$30 000–\$50 000, \$50 000 or more), the age of the youngest child in the household (none, less than six years, between six and 14 years, between 15 and 17 years), and geographical region (northeast, midwest, south, and west). Data from the tobacco use supplement questionnaire were used to create three additional demographic variables that assessed whether the respondent lived with current smokers, former smokers, and never smokers. Data for the demographic variables may have been derived from proxy reports.

To determine the level of household smoking restriction, self respondents were asked, "Which statement best describes the rules about smoking in your home?" Those who answered "No one is allowed to smoke anywhere" were classified as living under a total ban, while those who answered "Smoking is allowed in some places or at some times" were classified as living under a partial ban. The remaining respondents were classified as living in a household with no smoking restrictions. Employment status and workplace smoking restrictions among self respondents were used to assign each respondent to one of five categories (see below). The workplace policy questions were only asked of a subset of respondents who met the following criteria: (1) they worked in either the public or private sectors, and if they were self employed, they employed other workers; (2) they worked indoors, but not in someone's home. These respondents were asked, "Which of these best describes your place of work's smoking policy for indoor public or common areas such as lobbies, rest rooms, and lunch rooms?" and "Which of these best describes your place of work's smoking policy for work areas?" Those who answered "not allowed in any public areas" and "not allowed in any work areas" were classified as working in a smoke-free workplace, those who only answered "not allowed in any work areas" were classified as working under a work area ban, and the remainder were classified as working under less than a work area ban. Depending on employment status, the rest of the respondents were classified as either other workers or non-workers.

Table 1 Predictors of making a quit attempt in the last year in the United States, 1992–1993 (CPS tobacco use supplement, 1992–1993;  $n = 48\ 584$ )

Variable	<i>n</i>	% Quit attempt †	Adjusted OR ‡	CI §
Live with a smoker				
No	26 355	52.1	1.00	—
Yes	22 229	37.7	0.77*	0.72 to 0.82
Live with former smoker				
No	37 755	42.7	1.00	—
Yes	10 829	55.6	1.24*	1.15 to 1.32
Live with never smoker				
No	13 348	43.3	1.00	—
Yes	35 236	46.3	1.00	0.92 to 1.08
Home smoking ban				
None	28 732	35.4	1.00	—
Partial	12 734	52.4	1.83*	1.72 to 1.93
Total	7 118	71.8	3.86*	3.57 to 4.18
Work smoking ban				
< Work area	9 230	43.6	1.00	—
Work area	4 695	44.6	1.04	0.94 to 1.14
Smoke free	7 871	51.0	1.14*	1.05 to 1.24
Other workers	6 170	44.0	1.11*	1.01 to 1.21
Not working	20 618	44.9	1.01	0.93 to 1.10

† Weighted percentages.

‡ Odds ratios adjusted for sex, age, ethnicity, education, income, occupation, region, age of youngest child in the household, and the other variables in the table.

§ CI = 95% confidence interval.

\* $p < 0.05$ .

#### STATISTICAL METHODS

The analyses of smoking behaviour included only persons who were self respondents. The public use data files for these three surveys, include a weighting variable for self respondents, so population estimates can be computed. The weights are computed to be consistent with 1990 US Census totals based on state population, and they are representative of the US population by sex, age, and race/ethnicity distributions. All percentages reported are weighted percentages computed using the weighting variable. Variance estimates were inflated by a factor of 1.29 (design effect) for computation of 95% confidence intervals (CI). The design effect arises from the sampling design and its deviation from a simple random sample.

A series of multiple logistic regression analyses was used to examine the association between smoking behaviour variables (dependent variables in the analyses) and smoking

restrictions in the workplace and home and household composition (living with a non-smoker, a former smoker, or a current smoker). The logistic analyses were adjusted for the respondent's sex, age group, ethnicity, level of education, occupation, family income, age of the youngest child in the household, and geographical region. One multiple logistic regression was conducted to identify the associations of household composition and workplace and home smoking restrictions, with a report of a quit attempt in the past year. A second multiple logistic regression, nested within the first analysis, was conducted on the smokers who made a quit attempt in the previous year to identify the association of household composition and smoking restrictions on successful quitting ( $\geq 6$  months). A third multiple logistic regression, also nested within the first analysis, was conducted on the current daily smokers to identify the association of household composition and smoking restrictions on light smoking.

#### Results

##### EFFECT OF WORK AND HOME SMOKING RESTRICTIONS ON QUIT ATTEMPTS

Table 1 shows the likelihood that a smoker reported an attempt to quit in the previous 12 months as a function of home and work smoking restrictions and household composition, adjusted for demographic variables (sex, age group, ethnicity, level of education, occupation, family income, age of the youngest child in the household, and geographical region) and the other variables in the table. Smokers who worked in a smoke-free workplace (odds ratio (OR) = 1.14) were more likely to report a quit attempt in the previous year than those who worked indoors with less than a work area ban. Similarly, smokers who lived under a partial home smoking ban (OR = 1.83) or a total home smoking ban (OR = 3.86) were more likely to report a quit attempt in the previous year than those who did not. In addition, smokers who lived with a former smoker (OR = 1.24) were more likely to report a quit attempt, while smokers who lived with another smoker (OR = 0.77) were less likely to report a quit attempt.

##### EFFECT OF WORK AND HOME SMOKING RESTRICTIONS ON SUCCESSFUL CESSATION

Table 2 shows the likelihood that a smoker who attempted to quit in the previous year had achieved successful cessation ( $\geq 6$  months) at the time of the interview as a function of home and work smoking restrictions and household composition adjusted for demographics and the other variables in the table. Smokers who made a quit attempt and worked in a smoke-free workplace (OR = 1.21) or who lived under either a partial home smoking ban (OR = 1.20) or a total home smoking ban (OR = 1.65) were more likely to have achieved successful cessation than those who did not. In addition, smokers who lived with a former smoker (OR = 1.29) were more likely to be quit for six months or longer, while those who

Table 2 Successful 6+ month cessation in smokers who made a quit attempt in the last year (CPS tobacco use supplement, 1992–1993;  $n = 22\ 079$ )

Variable	<i>n</i>	% Quit †	Adjusted OR ‡	CI §
Live with smoker				
No	13 770	13.3	1.00	—
Yes	8 309	8.5	0.72*	0.62 to 0.83
Live with former smoker				
No	16 044	10.2	1.00	—
Yes	6 035	15.1	1.29*	1.12 to 1.48
Live with never smoker				
No	5 804	11.8	1.00	—
Yes	16 275	11.4	0.98	0.82 to 1.17
Home smoking ban				
None	10 163	9.0	1.00	—
Partial	6 730	11.4	1.20*	1.05 to 1.38
Total	5 186	16.3	1.65*	1.43 to 1.91
Work smoking ban				
< Work area	4 005	10.4	1.00	—
Work area	2 094	9.7	0.93	0.73 to 1.18
Smoke free	3 982	13.4	1.21*	1.00 to 1.45
Other workers	2 707	10.3	1.07	0.86 to 1.33
Not working	9 291	12.0	1.14	0.94 to 1.39

† Weighted percentages.

‡ Odds ratios adjusted for gender, age, ethnicity, education, income, occupation, region, age of youngest child in the household, and the other variables in the table.

§ CI = 95% confidence interval.

\* $p < 0.05$ .



Table 3 Light smoking in continuing smokers (CPS tobacco use supplement, 1992–1993; *n* = 38 541)

Variable	<i>n</i>	% Light smokers †	Adjusted OR ‡	CI §
Live with smoker				
No	18 677	32.8	1.00	—
Yes	19 864	24.2	0.83*	0.77 to 0.89
Live with former smoker				
No	31 381	28.2	1.00	—
Yes	7 160	29.5	0.98	0.90 to 1.08
Live with never smoker				
No	10 607	24.4	1.00	—
Yes	27 934	29.9	1.04	0.94 to 1.15
Home smoking ban				
None	25 424	22.6	1.00	—
Partial	9 820	36.8	1.81*	1.69 to 1.95
Total	3 297	45.4	2.73*	2.46 to 3.04
Work smoking ban				
< Work area	7 651	25.7	1.00	—
Work area	3 858	28.6	1.10	0.97 to 1.24
Smoke-free	5 957	36.9	1.53*	1.38 to 1.70
Other workers	5 020	21.7	0.89	0.79 to 1.01
Not working	16 055	28.8	0.92	0.82 to 1.02

† Weighted percentages.

‡ Odds ratios adjusted for gender, age, ethnicity, education, income, occupation, region, age of youngest child in the household, and the other variables in the table.

§ 95% confidence interval.

\**p* < 0.05.

lived with another smoker (OR = 0.72) were less likely to be quit that long.

#### EFFECT OF WORK AND HOME SMOKING RESTRICTIONS ON CONSUMPTION

Table 3 shows the likelihood that a current daily smoker was a light smoker (that is, smoked less than 15 cigarettes a day) as a function of home and work smoking restrictions and household composition (adjusted for demographics). Smokers were more likely to be light smokers if they worked in a smoke-free workplace (OR = 1.53), or if they lived under a partial (OR = 1.81) or a total ban (OR = 2.73) on smoking in the home than those who did not. In addition, smokers who lived with another smoker (OR = 0.83) were less likely to be light smokers.

#### Discussion

In this large nationally representative sample of smokers, household smoking restrictions were more strongly associated with smoking and quitting behaviours than were workplace smoking restrictions. Total household bans on smoking were associated with higher rates of cessation attempts, successful cessation, and light smoking than were partial bans. Partial bans, in turn, were associated with higher rates of these behaviours than were no restrictions on household smoking. In contrast, only smoke-free work places were associated with higher rates of cessation attempts, successful cessation, and light smoking. Workplace policies that restricted smoking in the work area only were not associated with any significant differences in smoking and quitting behaviours.

While an association between a smoking restriction and a smoking behaviour is necessary, it is not sufficient to establish that a particular causal relation exists between the restriction and the behaviour. There are three ways in which smoking restrictions and behaviours could be causally related. First, changes in smoking restrictions may cause the changes

in smoking behaviours. For example, the non-smokers in a household may convince the smoker to smoke outside the household and this restriction may later contribute to the smoker's decision to quit. Second, changes in smoking behaviours may lead to the change in smoking restrictions. For example, a smoker may quit, and then, to reinforce the desire not to relapse, the ex-smoker or members of the household agree to adopt the smoking ban. Finally, both quitting and adoption of the home ban may occur simultaneously both for relapse prevention as mentioned above or to eliminate exposure to secondhand tobacco smoke for all household members if other family, friends, or visitors are smokers.

Since household restrictions have only recently become a focus of research interest, no population based prospective studies have been conducted to assess their effects.<sup>25</sup> In the case of workplace restrictions, where prospective studies have been conducted, the data support a causal relation between the imposition of smoking bans and increased cessation and decreased consumption.<sup>5–17</sup> We are inclined to think that the level of household smoking restriction may be causally responsible for the increased rate of smoking cessation and the decreased rate of smoking consumption observed in the present study.

Assuming that smoking restrictions do modify smoking behaviours, there are two reasons why smoke-free households may be more effective than smoke-free workplaces in promoting cessation and in reducing consumption. First, the reasons for the adoption of a workplace smoking ban are varied; they include the protection of non-smokers from the hazards associated with exposure to secondhand tobacco smoke, as well as workplace safety (for example, fire prevention) and industrial hygiene (for example, prevention of product contamination). As long as the smoker complies with the policy at work, managers and coworkers may not care if the smoker continues to smoke outside of work. The smoker's situation at home is somewhat different, as the smoker's spouse or children may not be satisfied with compliance with the household smoking ban; instead, they may prefer that the smoker quit altogether. The presence of a home smoking ban may indicate stronger social pressure to quit smoking than does the presence of a workplace smoking ban, and this difference may account for the higher rate of cessation observed for smokers living under a home smoking ban. Second, work bans may also represent less of an impediment to smoking than do home bans. At work, the smoker can smoke immediately before and after work as well as during rest and meal breaks. Compensatory smoking may allow smokers to consume sufficient nicotine to maintain dependency. This may strengthen the ability of temporal cues to elicit the smoking response.<sup>26–31</sup> Conversely, the requirement to go outside the home to smoke may weaken the ability of various environmental cues (for example, finishing a meal, watching television, talking on the telephone) to elicit the smoking

response by forcing the smoker to choose between pleasurable activities (for example, smoking *v* watching a favourite television show). In addition, the requirement to go outside the house to smoke may disrupt smoking by causing the smoker to delay cigarettes (for example, because of the need to dress before going outside to smoke). These differences in household and workplace bans may account for the stronger associations with cessation observed for household bans in the present study.

These data show the need for a large longitudinal study of household smoking restrictions. Only prospective data will resolve the causal ambiguity encountered in the present study. Support for our conclusion that smoke-free households lead to higher rates of successful cessation will provide the public health community with a new weapon in the campaign against tobacco.

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